

receiving devices transmit their fast signalling messages during one and the same slot 221 in the reverse direction.

Figs. 3a, 3b and 3c illustrate some possibilities of accommodating several users into a single slot. A slot in general is defined as a certain frequency bandwidth during a certain duration of time. In fig. 3a the fast signalling slot 221 is divided in the frequency direction into subfrequencies the temporal duration of which is the same as the temporal duration of the whole slot 221. Each subfrequency consists of a fraction of the total bandwidth of the slot 221. In fig. 3b the division of a slot 221 into smaller capacity units is made in the time domain so that each subslot fills the whole frequency bandwidth but lasts only for a fraction of the total length of the slot 221. A subslot need not be longer than approximately 20 symbols in order to accommodate a training sequence of 12 to 16 symbols and possibly some information symbols. Guard periods must be used to separate consecutive subslots from each other, just like guard periods are used to separate the known transmissions in the timeslots of a frame from each other. Fig. 3c illustrates schematically the division of a slot 221 into subparts so that each subpart is characterised through a spreading code which is orthogonal or nearly orthogonal with the other codes used during the same slot. Various combinations of the basic solutions of figs. 3a, 3b and 3c are also possible.

Figs. 4a, 4b and 4c illustrate alternative ways of conveying information in a single fast signalling message. We assume that a training sequence must be a part of the structure of a fast signalling message in order to enable channel estimation in the device receiving the fast signalling messages and in order to provide a phase reference if and when a phase modulation scheme is employed. The location of the training sequence within the burst is unessential to the present invention; we assume for the sake of example only that the training sequence is in the middle of the burst. Fig. 4a illustrates the more conventional solution where the training sequence is always the same or at least its selection has no dependency on the information to be transmitted. Depending on which of a limited number of discretely defined phase conditions has been observed, certain information bits are selected that represent the observed phase condition, and these information bits are transmitted at the beginning and/or end of the burst. The discretely defined phase conditions are classes or bins like "observed phase difference greater than  $+\pi/4$  but at most equal to  $+\pi/2$ ", with the numerical limiting values selected according to application in question.

Fig. 4b illustrates another solution where there are at least as many mutually alternative training sequences as there are discretely defined phase conditions. A device that wants to declare the observation of a certain discretely defined phase condition just selects the training sequence that has been previously determined to represent that phase condition. From the viewpoint of just declaring the observation result it is then insignificant, what additional information if any is transmitted in the same burst (a burst may even consist of a training sequence only).

Fig. 4c illustrates a solution where a burst contains a shortened training sequence if information regarding observed phase conditions should also be transmitted. The space left free by the omitted parts of an original, longer training sequence are used to convey information regarding the observed phase conditions.

The location of the generally non-dedicated fast signalling channel in the channel scheme of a base station deserves some consideration. If the fast signalling channel comes without any reference to any forward direction channels at all, it is most advantageous to place the fast signalling channel onto a so-called common frequency, which is a frequency used by the mobile stations anyway. For example, each cell has a certain frequency on which the mobile stations may transmit their random access requests. This frequency could also be used for the fast signalling channel. It may even be worthwhile to consider multiplexing the random access channel and the fast signalling channel in some way: for example every second, third or in general Nth random access slot could be replaced with a fast signalling channel slot. This approach is especially advantageous in low-capacity base stations which only have one carrier frequency at their disposal.

Generally it may be helpful to have several fast signalling channel slots occur in various parts of the channel scheme of a base station so that if possible, mobile stations would not be forced to transmit fast signalling information simultaneously with receiving something else; of the several fast signalling channel slots each mobile station could choose a one that does not overlap with the reception time slots of that particular mobile station.

In many conventional cellular radio systems the transmission and reception frequencies come in pairs where a reverse direction frequency is always at a fixed frequency interval from a forward direction frequency. In an embodiment of the invention which is alternative to the above-mentioned use of a common frequency, all mobile stations which have received an allocation for a certain forward direction frequency use a certain slot on the corresponding reverse direction frequency as

their fast signalling channel slot. Such an arrangement implements automatically a virtually non-dedicated fast signalling channel because the division into allocated forward frequencies automatically divides the mobile stations into groups. An allocation of a fast signalling channel must be made also for those mobile stations that have no allocated forward direction frequency. For them it is possible to prescribe the use of a slot on the above-mentioned common frequency.

In the foregoing the emphasis has been in applying the invention in association with the use of transmitter diversity at the base station of a cellular radio system. However, the invention is equally applicable to all such situations where a relatively limited amount of information must be provided in one direction between the communicating devices. The changes that are required to the above-given description of applying the invention in association with the use of transmitter diversity are self-explanatory, such as replacing the "phase conditions" in figs. 4a, 4b and 4c with some other discrete classes of signalling information to be transmitted.

Fig. 5 illustrates schematically a method to be executed by a mobile station. At step 501 the mobile station detects that there exists a need for fast signalling. At step 502 it checks, whether it already has an active communication connection in the reverse direction; in the case of a positive finding the mobile station decides, at step 503, to reuse some of the capacity originally allocated for the active communication connection in the reverse direction for the purposes of fast signalling instead. A negative finding at step 502 means that the mobile station must resort to the use of a generally non-dedicated fast signalling channel, the corresponding slot of which it locates at step 504 unless it has already aware of its location in the channel scheme of the base station.

At step 505 the mobile station checks, whether it already has enough information that it needs to comply with the multiple access scheme on the non-dedicated fast signalling channel. The mobile station must know, how should it process its fast signalling messages in order to enable the base station to separate them from the stream of incoming fast signalling messages and to recognise them. Examples of such processing are transmission at a certain well-defined subfrequency, transmission during a certain well-defined subslot and/or spreading the transmission with a certain well-defined spreading code. The distribution of such information may be a part of the normal processes which the mobile station goes through while registering itself into a cell, in which case every mobile station always has enough information and step 505 is actually unnecessary, or the mobile station may have